CLAIMS

We claim:

1   1.   A system for dynamically and automatically selecting a clock frequency

2   for a resource accessed by zero or more controllers, wherein the clock frequency for the

3   resource at least in part determines the bandwidth supported by the resource, the system

4   comprising:

5   circuitry for generating a plurality of clocks of different frequencies;

6   circuitry for estimating the total bandwidth utilized by the zero or more

7   controllers accessing the resource;

8   circuitry for dynamically and automatically selecting one of the plurality of

9   clocks for the resource responsive to the estimated total bandwidth

10   utilization; and

11   circuitry for providing the selected clock to the resource.

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2   2.   The system of claim 1, wherein the resource is a memory controller for

2   controlling access to a memory using a memory clock and a clock enable signal and the

3   system further comprises:

4   circuitry for disabling the clock enable signal if the estimated total bandwidth

5   utilization for the controllers accessing the memory controller is zero;

6   and

7   circuitry for disabling the memory clock responsive to the disabling of the

8   clock enable signal.

1   3.   The system of claim 1, wherein the circuitry for estimating the total

2   bandwidth utilized by the zero or more controllers accessing the resource comprises:

3   a plurality of programmable registers, wherein each programmable register is

4   associated with at least one controller capable of accessing the

5   resource and each programmable register is adapted to hold a value

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6   describing the bandwidth utilized by the at least one associated

7   controller; and

8   adding circuitry in communication with the plurality of programmable

9   registers for adding the values held in registers associated with

10   controllers accessing the resource.

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4.   The system of claim 1, wherein the circuitry for dynamically and

2 automatically selecting one of the plurality of clocks for the resource responsive to the

3 estimated total bandwidth utilization comprises:

4   a multiplexer having a plurality of inputs for receiving the plurality of clocks

5   generated by the circuitry for generating a plurality of clocks and a

6   selection input for receiving a selection value determined in response

7   to the estimated total bandwidth utilized by the zero or more

8   controllers accessing the resource.

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1   5.   The system of claim 4, further comprising:

2   a frequency table in communication with the selection input to the multiplexer

3   and the circuitry for estimating the total bandwidth utilized by the zero

4   or more controllers accessing the resource for outputting the selection

5   value responsive to the estimated total bandwidth utilized by the zero

6   or more controllers accessing the resource.

1   6.   A portable electronic device comprising:

2   a plurality of resources for processing data, wherein the rate that a resource

3   processes data is at least partially determined by a frequency of a clock

4   received by the resource;

5   a clock generator for generating a plurality of clocks having different

6   frequencies;

7   a plurality of controllers for accessing the resources, wherein each controller is

8   adapted to access a resource at a given bandwidth; and

9   a clock controller in communication with the plurality of controllers and

10   receiving the plurality of clocks, the clock controller adapted to

11   dynamically and automatically select a clock of the plurality of clocks

12   for a resource responsive to the bandwidth utilized by the controllers

13   accessing the resource.

1   7.   The portable electronic device of claim 6, wherein the clock controller

2   further comprises:

3   a plurality of bandwidth registers, each bandwidth register associated with a

4   particular controller in the portable electronic device and adapted to

5   hold a value representative of the bandwidth utilized by the associated

6   controller.

1   8.   The portable electronic device of claim 7, wherein the clock controller

2   further comprises:

3   an adder for summing the contents of the bandwidth registers associated with

4   the controllers in the portable electronic device accessing the resource.

1   9.   The portable electronic device of claim 8, further comprising:

2   a frequency table having entries describing clock frequencies for a resource in

3   .   the portable electronic device, wherein the sum produced by the adder

4   is an index to an entry in the frequency table.

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1   10.   The portable electronic device of claim 8, wherein the clock controller

2   further comprises:

3   a multiplexer for receiving the plurality of clocks generated by the clock

4   generator and outputting a clock selected responsive to the sum

5   produced by the adder.

1   11.   The portable electronic device of claim 10, further comprising circuitry for

2   applying the selected clock to the resource.

12. The portable electronic device of claim 8, wherein the plurality of resources comprise:

    a bus for transferring information among ones of the plurality of controllers in communication with the bus;

    a memory controller in communication with the bus for controlling access to at least one external memory device by ones of the plurality of controllers; and

    a central processing unit controller in communication with the bus for controlling accesses to a central processing unit by ones of the plurality of controllers.

13. The portable electronic device of claim 12, wherein the memory controller communicates with the external memory device using a clock and a clock enable signal and the portable electronic device further comprises:

    circuitry for disabling the clock enable signal when the bandwidth utilized by the controllers accessing the memory is zero; and

    circuitry for terminating the memory clock when the clock enable signal is disabled.

14. A method of selecting one of a plurality of clocks having different frequencies for a resource, wherein the clock frequency determines at least in part the bandwidth that the resource can process, comprising the steps of:

    determining whether zero or more controllers are accessing the resource;

    estimating bandwidth utilized by the zero or more controllers accessing the resource;

    dynamically and automatically selecting one of the plurality of clocks responsive to the estimated bandwidth utilized by the zero or more controllers accessing the resource; and

    applying the selected clock to the resource.

1   15.   The method of claim 14, wherein the step of estimating bandwidth utilized

2   by the zero or more controllers accessing the resource comprises the steps of:

3   assigning a value to each controller representative of the bandwidth utilized by

4   that controller; and

5   summing the values assigned to the controllers that are accessing the resource.

1   16.   The method of claim 15, wherein the step of dynamically and

2   automatically selecting one of the plurality of clocks responsive to the estimated

3   bandwidth utilized by the zero or more controllers accessing the resource comprises the

4   step of:

5   selecting one of the plurality of clocks with the sum.

Sub 04   17.   The method of claim 14, wherein the resource is a memory controller and

2   the determining step determines that zero controllers are accessing the memory controller,

3   further comprising the steps of:

4   disabling a clock enable signal from the memory controller; and

5   disabling a clock to the memory controller.

1   18.   An application-specific integrated circuit for processing data, the circuit

2   comprising:

3   a plurality of programmable registers for holding values, wherein each register

4   is adapted to hold a value describing data processing rate of an

5   associated device;

6   an adder in communication with the plurality of programmable registers for

7   summing the values in ones of the plurality of registers associated with

8   devices accessing a resource, wherein the sum describes the total data

9   processing rate of the devices accessing the resource; and

10   selection circuitry in communication with the adder for selecting one of a

11   plurality of clock frequencies for the resource responsive to the sum

12   produced by the adder.

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1   19.   The application-specific integrated circuit of claim 18, further comprising:

2   a frequency table in communication with the adder and the selection circuitry

3   for converting the sum produced by the adder into a selection value for

4   use by the selection circuitry for selecting one of the plurality of clock

5   frequencies.

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